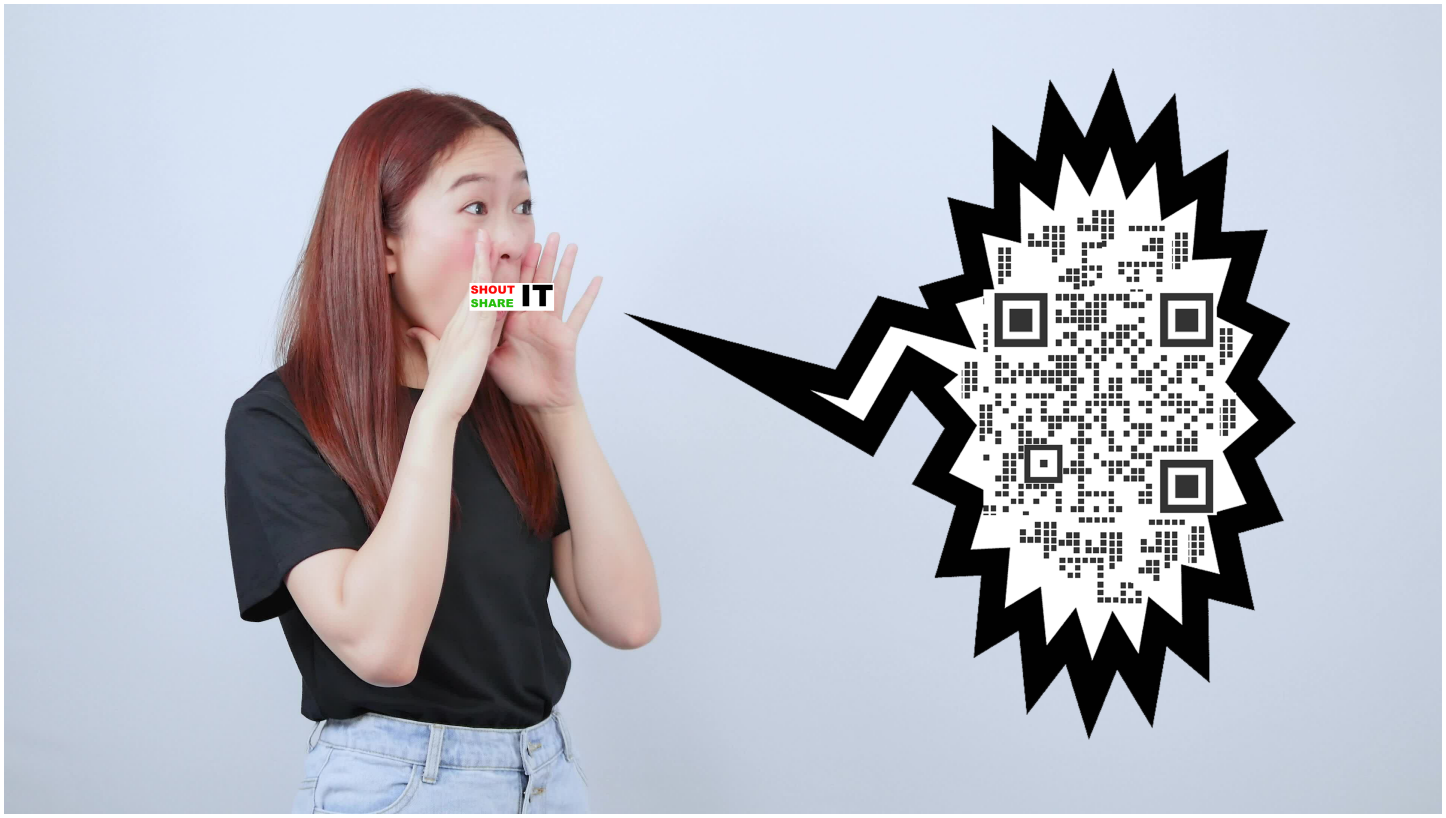
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Spodic Horizon Characteristics of Some Forest Soils in the White Mountains, New Hampshire

by

S. A. L. Pilgrim and R. D. Harter

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PREFACE

This publication is a result of the research program of the Institute of Natural and Environmental Resources. The Institute is a multi-disciplinary group of scientists involved in a coordinated program of research, teaching and extension. The research effort encompasses investigations of: problems affecting the quality of the environment, economics of agriculture, forest and wildlife resources, the efficient use and conservation of water and soil, and regional and community planning and development.

ABSTRACT

A recent detailed study of several soils in the Bartlett Experimental Forest of Central White Mountains, New Hampshire, has provided an opportunity to more fully characterize spodic horizons in the region and to evaluate problems arising in their classification using definitions in Soil Taxonomy (Soil Survey Staff, 1975). All studied soils have at least one horizon that meets chemical criteria for classification as spodic. These horizons have little clay and considerable accumulation of amorphous materials as indicated by values of up to 60 me/100g for cation exchange capacity, 2.5% dithionite extractable iron and 7.4% organic matter. In four pedons, the horizon meeting chemical criteria for spodic did not meet depth requirements for classification as spodic within the frigid temperature regime. The relatively thin spodic horizons present problems in the application of wetness criteria for subgroup placement. Disruption of horizontal extension of the albic and spodic horizons by tree throw activity lead to questions in great group placement. Some consideration of such problems in classification of steeply sloping, non-cultivated soils of mountainous regions within the frigid temperature regime is suggested.

Additional words for indexing: Soil Taxonomy, Typic subgroups, Fragiorthods, Haplorthods, Chemical classification.

Spodic Horizon Characteristics of Some Forest Soils in the White Mountains, New Hampshire

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S. A. L. Pilgrim and R. D. Harter*

Whereas over the past forty years or so soil scientists' detailed studies of New Hampshire soils have primarily emphasized cropland and other non-forest uses, recently more attention has been directed toward the study of forest soils. This has created certain taxonomic problems in that classification criteria used in cultivated areas is not always adaptable to virgin soils of forested areas. This became particularly apparent during the detailed study of several soils in the Bartlett Experimental Forest of central White Mountains, New Hampshire.

Hoyle (1973) described soils of the study area as typically Podzol except where gleization has occurred in poorly drained sites. The soil survey of Carrol County (1977) described the poorly drained soils as inclusions in a matrix of Spodosols. The soils of the area conform to Lyford's (1946) concept of a Podzol, and it is presumed that classical processes described by Stobbe and Wright (1959) have operated.

The purpose of this paper is to present data on chemical and physical properties and morphological characteristics for several forest soils, primarily Orthods, to more fully characterize spodic horizons in the White Mountains of New Hampshire. The classification of these soils using definitions in Soil Taxonomy (Soil Survey Staff, 1975) is also discussed.

METHODS AND MATERIALS

Description of the Soils

The study area is located on the Bartlett Experimental Forest within the White Mountain National Forest and in the northwestern part of Carroll County, New Hampshire (Fig. 1). Elevations range from 290 to 515 meters above sea level at the pedon sites. The climate is cool temperate and humid. Mean annual precipitation is about 130 cm, with approximately half falling as snow. Soils in the area are classified as Aquic or Typic subgroup of Haplorthods and Fragiorthods with a frigid soil temperature regime (Soil Survey of Carrol County, New Hampshire 1977). The vegetation is dominated by northern hardwood forests.

A selected pedon is described in detail for both Haplorthods and Fragiorthods. Some important properties of other sampled pedons are included in Tables 1 and 3. Descriptions for other pedons are in the appendix.

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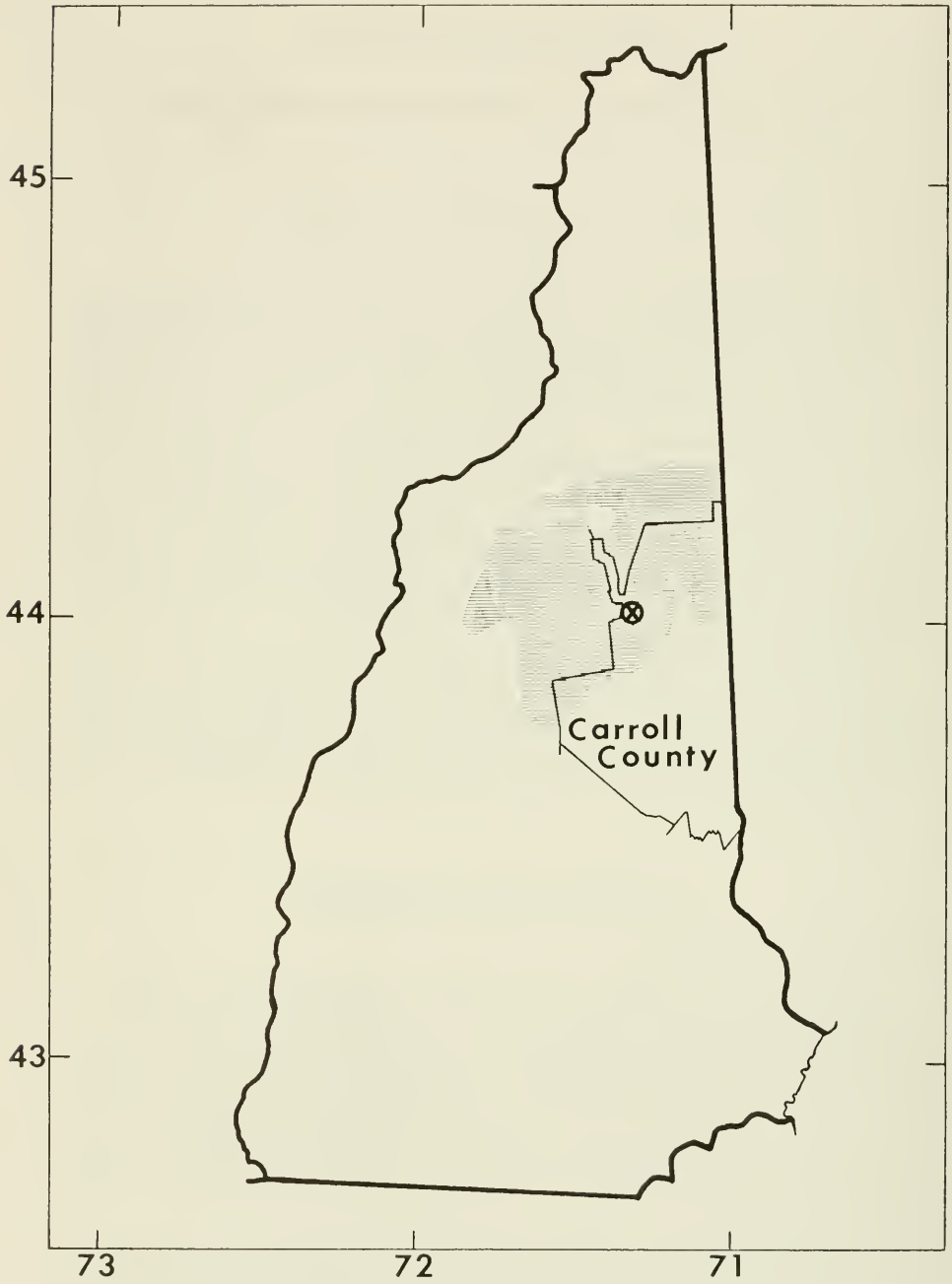

FIGURE LEGEND

FIGURE 1: Map of New Hampshire showing approximate sampling location, White Mountains indicated by shading. **FIGURE 2:** Forest ecosystem showing microrelief due to wind-throw disturbance and the profile of soils associated with mound and non-mound areas.

Haplorthods — Selected Pedon

Waumbek series, Taxadjunct (Pedon 3). The site location is 463m, above sea level on a toe slope position of the glaciated uplands. The pedon site is located approximately in the center of compartment 30. This moderately well drained soil developed in stony sandy glacial till derived mostly from granitic and schistose rocks. Dominant vegetation is yellow birch *(Betula lutea)* and sugar maple *(Acer saccharum)*.

Horizon	*Depth cm*	*Description*
021	8-6	Loose leaf litter.
022	6-0	Well decomposed forest floor litter; black (10YR 2/1); extremely acid; many roots; abrupt smooth boundary.
A2	0-3	Dark grayish-brown (10 YR 4/2) and grayish-brown (2.5Y 5/2) coarse sandy loam; weak medium granular structure; friable; extremely acid; roots are common; 10 percent coarse fragments; abrupt broken boundary.
B21h	3-8	Dark reddish-brown (5YR 2/2) coarse sandy loam; moderate medium granular structure; friable; very strongly acid; many roots; 3 percent coarse fragments; abrupt broken boundary.
B22ir	8-23	Dark brown (10YR 3/3) gravelly coarse loamy sand; moderate medium granular structure; friable; very strongly acid; many roots; 35 percent coarse fragments; clear wavy boundary.
B23ir	23-51	Dark brown (7.5YR 4/4) very gravelly coarse sand; massive; weakly cemented in places; strongly acid; roots are common; 60 percent coarse fragments; clear wavy boundary.
B24	51-76	Mottled brown (10YR 5/3) and grayish-brown (10YR 5/2) very gravelly coarse sand; massive; weakly cemented in places; strongly acid; roots are common; 60 percent coarse fragments; abrupt smooth boundary.
C	76-109	Mottled grayish-brown (10YR 5/2) and grayish-brown (2.5Y 5/2) sand; massive; friable; strongly acid; few roots; 15 percent coarse fragments; water bearing lenses at top of this horizon; water worked glacial till.

Fragiorthods — Selected Pedon

Marlow series (Pedon 5). The site location is 400m above sea level on a mid-slope position of the glaciated uplands. The pedon site is located in the southwestern corner of compartment 22, about 60 meters north of Bear Notch Road. This well drained soil developed in glacial till and has a compact pan at 84 cm. Dominant vegetation is beech *(Fagus grandifolia)* with striped maple *(Acer pennsylvanicum)* and sugar maple *(Acer saccharum)*.

Horizon	*Depth cm*	*Description*
021	8-4	Loose leaf litter.
022	4-0	Well decomposed forest floor litter; very dark grayish brown (10YR 3/2); very strongly acid; many roots.
A2	0-5	Pinkish gray (7.5YR 6/2) fine sandy loam; weak fine granular structure; friable; very strongly acid; roots are common; abrupt broken boundary.

B21h	5-13	Dark brown (7.5YR 3/2) fine sandy loam; moderate medium granular structure; friable; very strongly acid; many roots; 5 percent coarse fragments; abrupt broken boundary;
B22ir	13-20	Dark reddish brown (5YR 3/4) fine sandy loam; moderate medium granular structure; friable; strongly acid; many roots; 5 percent coarse fragments; clear wavy boundary.
B23ir	20-41	Strong brown (7.5YR 5/6) gravelly fine sandy loam; moderate medium granular structure; friable; strongly acid; roots are common; 30 percent coarse fragments; clear wavy boundary.
B24	41-53	Yellowish brown (10YR 5/6) gravelly fine sandy loam; moderate medium granular structure; friable; strongly acid; roots are common; 25 percent coarse fragments; gradual wavy boundary.
B3	53-84	Yellowish brown (10YR 5/4) gravelly sandy loam matrix with yellowish red (5YR 5/8) streaks and a few fine distinct light brownish gray (2.5Y 6/2) mottles; weak thick platy structure; friable; strongly acid; few roots; 40 percent coarse fragments; fabric includes lenses of fine and medium sand up to 2 inches in thickness and in horizontal orientation; abrupt wavy boundary.
Cx	84-114	Light olive brown (2.5Y 5/4) gravelly fine sandy loam matrix with yellowish brown (10YR 5/6) streaks; massive; firm; medium acid; few roots; 25 percent coarse fragments; weathered Conway granite fragments up to 4 inches in diameter are common; silt caps on coarse fragments.

Analytic methods

Particle-size distribution was determined by a modification of the Steele and Bradfield (1934) sedimentation method. Except as noted, amounts of chemical constituents were determined by standard procedures as outlined in the Soil Survey Laboratory Manual (Soil Survey Staff, 1972). The soil was extracted by pH 7.0 NH40Ac. K, Na, Ca, and Mg in the extract were ascertained by Flame Emission/Atomic Absorption Spectrophotometry, Exchangeable Bases by ignition and titration of the extract (Chapman, 1965), and cation exchange capacity by distillation of ammonia from the soil after having removed all excess salts. Extractable acidity was assayed by extraction with pH 8.2 BaC12-triethanolamine buffer and titration of the extract. Organic Carbon was obtained by acid dichromate digestion and nitrogen by Kjeldahl analysis. Iron and aluminum were assessed by both dithionite-citrate and sodium pyrophosphate extraction, followed by Atomic Adsorption analysis. For the index of accumulation, cation exchange capacity was taken as the sum of titratable acidity and exchangeable bases.

RESULTS AND DISCUSSION

Spodic horizons are defined in Soil Taxonomy (Soil Survey Staff, 1975) as either having a subhorizon continuously cemented with organic matter and iron

and/or aluminum, having a coarse texture with cracked coatings on sand grains or distinct silt size dark pellets present, or satisfying certain chemical criteria. The chemical criteria are a) the ratio of pyrophosphate extractable Fe + Al to clay is at least 0.2 (if Fe is>0.1%, percent carbon is substituted); b) at least half the amorphous Fe and Al is complexed with organic matter; and c) the index of amorphous material accumulation [(CEC − %clay/2)x(horizon thickness)] must be at least 65. Furthermore, the spodic horizon has a specific depth requirement dependent on the soil temperature regime and the presence or absence of an Ap horizon. Spodic horizon requirements for soils lacking an Ap horizon must be met below a depth of 12.5 cm for frigid or warmer soil temperature regimes (Ap horizons are not present in mountainous regions such as the area of sampling). Cryic or pergelic soil temperature regimes have no requirement for depth.

The studied soils all have morphological characteristics of Spodosols. All pedons have at least one subsurface horizon meeting the chemical property criteria for spodic horizons. Typical spodic horizon characteristics of wide C/N ratios, low base status, high extractable acidity, and accumulations of illuvial C, Fe, and Al characterize each pedon (Table 1). At least one subhorizon in each pedon meets the requirement that the ratio of pyrophosphate-extractable Fe + Al to clay must be at least 0.2 (Table 2). The requirement that at least half the amorphous Fe and Al must be organically bound, that is the ratio between pyrophosphate-extractable Fe + Al and dithionite- citrate extractable Fe + Al must be at least 0.5, is also met in at least one subhorizon. Index of amorphous material accumulation is not a limitation in classification of these soils as spodic, since the B horizons of non-orthods as well as orthods in the area have an index well above the required 65. However, one must keep in mind that in applying the criteria of Soil Taxonomy, only that qualifying part of the spodic horizon below 12.5 cm. is used. The B21h horizon of Pedon 1 is an example. The index of accumulation for this horizon is 448. The depth of this horizon is from 5 to 13 cm. Soil Taxonomy requirements are for the 12.5 to 13.0 cm. part of this horizon to be used for spodic horizon determination. The accumulation index for this part on an equal weight basis is 28 and hence does not qualify for spodic. None of the pedons have a continuously cemented horizon (Table 3). Cracked coatings on sand grains are not readily evident and dark pellets of silt size, if present, are probably hornblende remnants.

Four pedons (pedons 1, 6, 7, and 9) fail to meet the depth requirement for classification as spodic under frigid temperature regimes. We have used the surface of the mineral soil as the point of reference for depth measurements. However, Soil Taxonomy is not specific as to the point of measurement. If the surface of the forest floor were used as the point of reference, all pedons would easily meet the depth requirements of spodic horizons. The thickness of 021 and 022 horizons ranged from 3.5 to 9.0 cm. Hoyle (1973) has reported the importance of humus (022 horizon) as the main source of nutrients for forest vegetation in the study area. The significant role of these 0 horizons in nutrient cycling suggests to us that they should be included in depth measurements. A more critical question than reference point for measurement, however, is whether a depth requirement is even needed for mountainous soils within the frigid zone. The soils of the sample area have long been considered to be Orthods, and are managed as such. Yet, four of the nine soils apparently do not meet depth requirements for classification as Orthods. In view of the chemical

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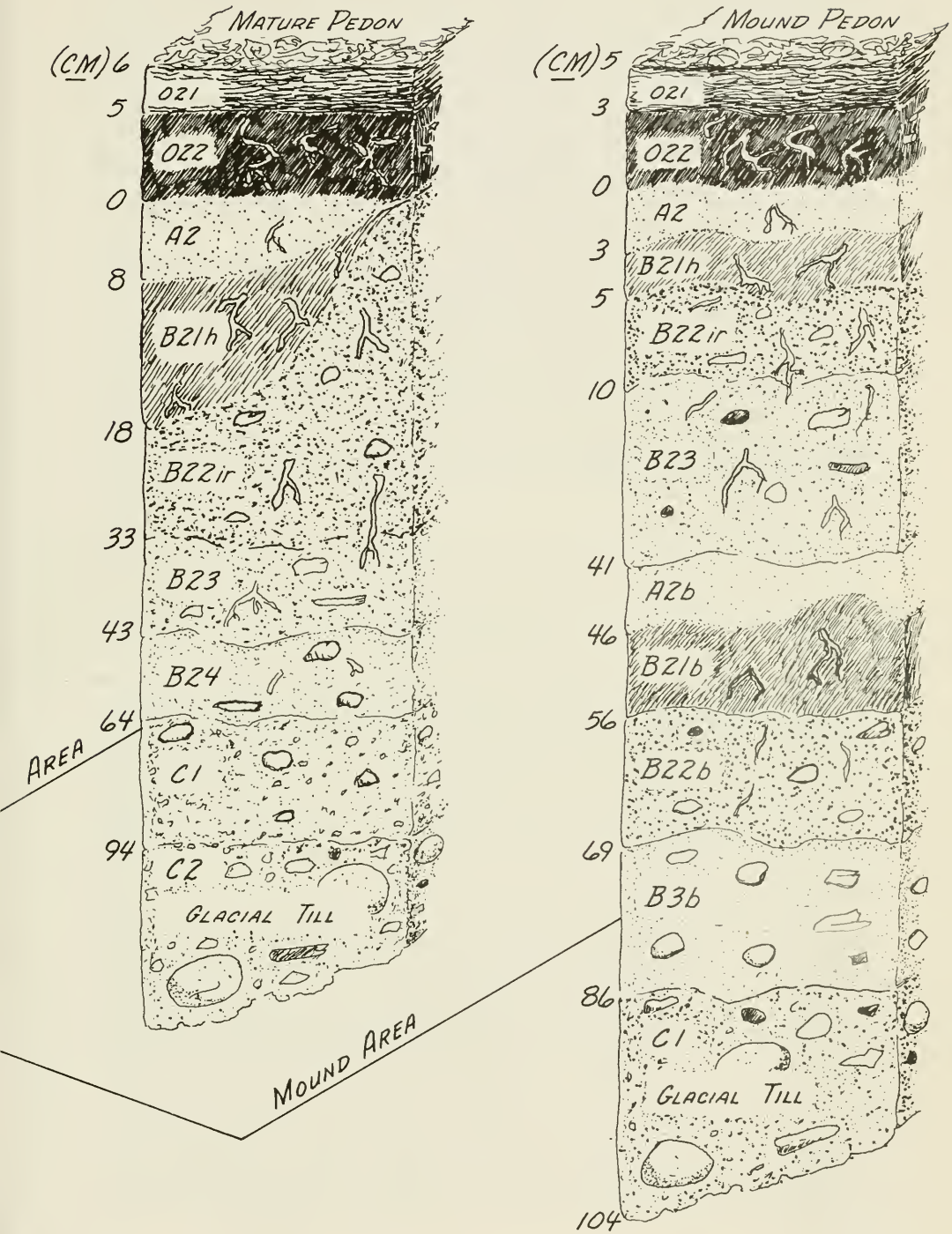

characteristics of the studied soils (tables 1 and 2), we feel that frigid soils could logically be classed with cryic and pergelic soils in having no depth requirement for non-cultivated soils in mountainous areas.

The distinction between the Typic and Entic subgroups in Soil Taxonomy is based on presence within the spodic horizon of either an orstein horizon, designated texture and carbon content of the upper 10 cm or designated texture and color of the upper 7.5 cm. None of the sampled soils has an ortstein horizon (Table 3). Texture requirements for Typic subgroup placement are met in all soils, so placement depends upon color and/or carbon content. Color value and chroma of 3 or less in at least the upper 7.5 cm or organic carbon accumulations of 1.2% (weighted average) in the upper 10 cm of the spodic horizon is necessary for either Haplorthods or Fragiorthods to be designated Typic. Four of the five pedons with qualifying spodic horizons meet requirements for the Typic subgroup on the basis of soil color. Organic carbon accumulations in the upper 10 cm of the spodic horizon qualifies the fifth pedon for the Typic subgroup.

It should be noted that spodic horizons in the study area are not continuous horizons. The microrelief of the forest floor is characterized by small mounds. Tipover of trees by wind has resulted in disturbance of soil horizons in the upper part of the solum (fig 2). Lyford and MacLean (1966) described a similar phenomenon in New Brunswick, Canada. The excavated pits used in this study showed the intermittent character of A2 and B21h horizons and occasionally the B22ir. The horizontal extension of these horizons was commonly broken within a few meters.

The morphology of soils occuring on mounds commonly differs from soils in non-mound areas in several ways. The mound soils may exhibit buried A2 and B2 horizons at 50 cm or so of depth. Pedon No. 10 (Appendix) was described on a tree throw mound. Relatively thin B21 and B22 horizons with characteristic colors of a spodic have developed in the mounded material. Younger mounds commonly lack the dark reddish brown and associated colors of spodic horizons. Soils occuring in the non-mound areas (not to be confused with depressions associated with mounds) almost always lack buried horizons. We refer to soils occurring in the non-mound areas as mature pedons. The morphology of these soils suggests an older age and less disturbance than soils occurring on mounds. Tables 1 and 2 present data for nine mature pedons. Further study is needed to more fully characterize the spacing variability of mounds, their proportional extent in the landscape, and the classification of soils located on mound positions.

Several pedons used in this paper provide an opportunity to test wetness criteria used in Soil Taxonomy (Soil Survey Staff, 1975) for Aquic subgroups of Orthods. Wetness criteria for Aquic Haplorthods includes distinct or prominent mottles in the spodic horizon or having chroma of 2 or less dominant in the matrix within 15 cm of the base of the spodic horizon and within one meter of the surface. Our interpretation of this criteria is that it applies only to B2 horizons qualifying as spodic. The B21h and B22ir horizons of Pedon 3 qualify for spodic. These horizons lack distinct or prominent mottles. Additionally, chroma of 2 or less do not occur within 15 cm below the B22ir horizon. Low chroma mottles are described for Pedon 3 in B24 horizon (51 to 76 cm). If one uses depth to mottles criteria provided in official series descriptions, this pedon is classified as the Waumbek Series (Rev. 7/20/72). The range in characteristics

provides for mottles from 40 to 75 cm. The current subgroup placement for the Waumbek Series is Aquic Haplorthods. The placement of Pedon 3 using criteria in Soil Taxonomy, however, is Typic Haplorthods and hence the classification of the pedon as a taxadjunct to the Waumbek series. Evidence of wetness as currently defined in Soil Taxonomy provides for Haplorthods with seasonal high water table levels within 40 to 75 cm from the surface to be placed in the Typic Haplorthods subgroup. This results in the placement of soils with widely different seasonal water table levels in Typic Haplorthods. It would appear that an improvement could result if wetness criteria for Aquic Haplorthods were applied to B horizons (including non-spodic horizons).

The organic carbon content of the intermittent B21h horizons ranges up to 7.4 percent in the sampled pedons. However, these pedons either lack the less than 0.2 ratio of free iron to carbon required for Humic subgroups of Fragiorthods and Haplorthods or the requirement for weighted average value of more than 6 percent organic carbon in the upper 10 cm of the spodic horizon.

There is a need for additional study of soil temperature regimes in the White Mountains. Preliminary data indicates that the the pedons used in this study qualify for the frigid temperature regime. However, the elevations of sample sites ranged only up to 515 meters. Summer and Fall 1967 temperature data at two sites (elevations 615 and 990m) on Bear Mountain for very shallow soils (unpublished) suggested a cryic soil temperature regime. At this time, we lack information to establish elevation guidelines at this latitude to separate frigid and cryic soil temperature regimes.

SUMMARY

Spodic horizons in forested soils of the White Mountains can be characterized as having maximum morphological expression within 15 cm or so of the mineral surface. Sub-horizons of the B below this depth commonly do not qualify for spodic, even though solum depth generally extends to more than 60 cm. Five of the nine sampled pedons in this study had horizons qualifying for spodic. Four pedons did not meet depth requirements for spodic used in Soil Taxonomy. However, these pedons did have at least one subsurface horizon that met the chemical criteria for spodic. Relatively thin spodic horizons, as those of the study area, present problems in the application of wetness criteria used in Soil Taxonomy for subgroup placement. This results in grouping soils with widely different seasonal water table levels in the subgroup, Typic Haplorthods. Disturbance of the forest floor by tree throw activity has disrupted the horizontal extension of albic and spodic horizons. This study characterized soils occurring in the frigid soil temperature zone. There is a need to study Orthods in the White Mountains with a cryic soil temperature regime.

TABLE 1: Some Selected Chemical And Physical Characteristics Of Sampled Soils. (blank = no data, - = trace amounts)

Horizon	Depth	Sand	Silt	Clay	Organic C	Total N	pH (H2O)	Titratable Acidity (pH 8.2)	Exchange Bases	CEC (pH 7.0)	Exchange Cations K	Na	Ca	Mg	Citrate-Dithionite Fe	Citrate-Dithionite Al	Pyrophosphate Fe	Pyrophosphate Al
	cm				%				me/100g								%	
						HAPLORTHODS												
						Unnamed Series (Pedon 1)												
O22	4-0				40.3	1.4	4.1	110.2	9.2	90.0	1.1	0.2	5.9	2.2	0.24	0.09	0.20	0.12
A2	0-5	61.4	35.8	2.8	1.7	0.1	3.6	9.6	0.5	5.3	0.2	-	0.2	0.1	0.37	0.04	0.06	0.04
B21h	5-13	49.5	44.6	5.9	6.4	0.4		57.4	1.6	33.3	0.3	0.1	0.3	0.1	2.48	0.92	1.05	0.75
B22ir	13-33	61.1	34.8	4.1	1.9	0.1	5.0	19.5	0.6	10.2	0.1	-	0.1	-	1.35	0.58	0.13	0.29
B23	33-58	76.7	20.9	2.4	1.0	o.1	5.1	10.2	0.1	4.8	0.1	-	0.1	-	0.58	0.30	0.06	0.17
IIC	58-102	91.1	7.0	1.9	1.0	0.1	5.1	9.4	o.6	4.5	0.1	0.1	0.1	-	0.44	0.27	0.06	0.16
						Unnamed Series (Pedon 2)												
O22	5-0				37.1	1.5		114.1	7.0	82.3	1.0	0.4	5.1	0.7	0.37	0.13	0.20	0.07
A2	0-8	57.6	38.9	3.5	0.5	0.1	4.0	4.7	0.3	3.7	0.1	0.1	0.1	-	0.14	0.04	0.04	0.02
B21h	8-18	58.8	37.4	3.8	2.7	0.2	4.9	22.8	2.4	11.0	0.1	0.1	0.3	-	2.04	0.43	1.16	0.28
B22ir	18-33	62.2	31.8	6.0	1.4	0.1	5.0	15.2	0.8	7.4	0.1	0.1	0.2	-	1.31	0.34	0.49	0.18
B23	33-43	66.4	29.4	4.2	0.8	0.1	5.1	9.6	0.6	5.5	-	0.1	0.1	-	0.69	0.21	0.39	0.14
B24	43-64	70.8	27.8	1.4	0.4	-	5.3	4.6	0.5	1.7	-	0.1	0.1	-	0.53	0.13	0.13	0.07
C1	64-94	60.7	36.7	2.6	0.3	-	5.3	2.8	0.6	2.2	0.1	0.1	0.1	-	0.34	0.08	0.03	0.04
C2	94-109	65.4	32.1	2.5	-	-	5.4	1.3	0.9	0.9	0.1	0.1	0.4	-	0.38	0.04	0.02	0.02
						Waumbek Series, taxadjunct (Pedon 3)												
O22	6-0				47.4	1.9	3.6	136.1	18.8	119.8	1.3	0.4	13.5	1.8	0.15	0.08	0.06	0.04
A2	0-3	65.6	29.8	4.6	1.6	0.1	3.8	8.5	0.7	6.6	0.9	0.7	0.6	0.5	0.46	0.06	0.10	0.02
B21h	3-8	58.9	33.2	7.9	4.9	0.4	4.1	38.5	2.7	25.4	0.2	0.2	1.3	0.1	2.31	0.31	1.58	0.19
B22ir	8-23	78.6	17.5	3.9	2.5	0.2	4.9	20.9	0.4	12.3	0.1	0.1	0.2	-	1.30	0.53	0.59	0.33
B23ir	23-51	90.9	5.8	3.3	0.8	0.1	5.0	12.2	0.3	4.9	0.1	0.1	0.1	-	0.75	0.27	0.32	0.14
B24	51-76	93.6	3.8	2.6	0.8	0.1	5.1	6.4	0.5	3.3	0.1	0.1	0.1	-	0.65	0.23	0.19	0.11
C	76-109	90.7	7.5	1.8	0.3	-	5.1	1.6	0.2	1.9	0.1	0.1	0.1	-	0.30	0.06	0.03	0.02
						Unnamed Series (Pedon 4)												
O22	3-0				17.9	1.0		33.7	8.0	42.7	0.8	0.4	6.1	0.6	0.36	0.07	0.11	0.01
A2	0-8	76.5	21.7	1.8	1.2	0.1	4.3	4.1	0.6	4.5	0.1	0.2	0.4	-	0.17	0.04	0.01	0.01
B21h	8-10	60.9	34.5	4.6	4.0	0.3		38.0	1.4	21.6	0.2	0.2	1.1	0.1	2.49	0.31	1.65	0.24
B22ir	10-20	61.9	34.5	3.9	4.2	0.3	4.8	39.3	1.3	24.0	0.1	0.1	0.2	-	1.79	0.78	1.10	0.54
B23	20-38	70.5	25.4	4.1	1.8	0.1	5.1	20.3	0.6	11.9	-	0.2	0.1	-	1.20	0.59	0.34	0.24
B24	38-61	74.6	20.6	4.8	1.0	0.1	5.1	11.7	0.7	6.6	-	0.1	0.2	-	1.07	0.31	0.25	0.16
	61-89	87.4	8.6	4.0	0.5	0.1	5.1	7.2	0.3	3.9	-	0.2	0.1	-	0.75	0.17	o.21	0.12

Table 1: (cont.)

Horizon	Depth	Sand	Silt	Clay	Organic C	Total N	pH (H2O)	Titratable Acidity (pH 8.2)	Exchange Bases	CEC (pH 7.0)	Exchange Cations K	Na	Ca	Mg	Citrate-Dithionite Fe	Al	Pyrophosphate Fe	Al
	cm				%					me/100g							%	
								FRAGIORTHODS										
								Marlow Series (Pedon 5)										
O22	4-0				15.4	0.8		38.5	5.2	31.9	0.7	0.1	4.7	0.6	0.65	0.15	0.32	0.05
A2	0-5	58.0	40.2	1.8	1.1	0.1	4.1	4.7	0.5	4.0	0.1	0.1	0.3	0.1	0.25	0.05	0.09	0.02
B21h	5-13	55.2	39.7	5.1	3.0	0.2	4.5	24.9	1.5	13.0	0.2	0.2	0.8	0.1	1.91	0.28	1.13	0.18
B22ir	13-20	56.2	40.2	3.6	1.6	0.1	5.0	13.6	0.8	8.4	0.1	0.1	0.3	0.1	1.16	0.31	0.65	0.19
B23ir	20-41	66.4	30.0	3.6	0.9	0.1	5.1	9.3	0.3	4.9	0.1	0.1	0.2	-	0.87	0.24	0.42	0.29
B24	41-53	68.7	28.5	2.8	0.6	0.1	5.3	7.6	0.4	3.8	0.1	-	0.2	-	0.81	0.20	0.36	0.23
B3	53-84	81.8	17.8	0.4	0.3	-	5.2	3.3	0.4	1.8	0.1	0.1	0.1	-	0.43	0.11	0.16	0.10
Cx	84-114	62.2	36.7	1.1	0.4	-	5.2	3.0	0.6	1.2	0.1	-	0.1	-	0.45	0.09	0.13	0.04
								Unnamed Series (Pedon 6)										
O22	8-0				37.1	1.6	4.8	103.0	7.3	71.4	1.0	0.2	4.9	0.9	0.19	0.95	0.09	0.61
A2	0-3	73.6	23.6	2.8	2.6	0.2		11.1	1.4	8.8	0.2	0.1	0.9	0.2	0.31	0.10	0.10	0.06
B21h	3-13	64.2	31.7	4.1	2.6	0.2	5.0	24.9	1.1	11.5	0.3	0.1	0.5	0.1	1.75	0.41	1.06	0.30
B22ir	13-43	68.2	27.0	4.8	0.8	0.1	5.3	14.0	0.4	6.0	0.2	-	0.2	-	1.04	0.37	0.46	0.18
B3	43-94	91.1	7.0	1.9	0.4	0.1	5.3	4.8	0.4	2.9	0.1	0.1	0.1	-	0.57	0.14	0.21	0.07
Cx	94-114	54.9	43.9	1.2	0.2	-	5.2	3.5	0.4	2.9	0.1	0.1	0.1	-	0.66	0.10	0.19	0.04
								Unnamed Series (Pedon 7)										
O22	8-0				25.6	1.3	4.6	90.7	4.4	51.0	0.6	0.2	2.9	0.5	0.39	0.75	0.22	0.47
A2	0-5	63.8	32.5	3.7	1.9	0.1	4.6	8.5	0.3	7.6	0.1	0.1	0.2	0.1	0.30	0.10	0.09	0.06
B21h	5-13	53.1	43.5	3.4	3.3	0.2		36.9	1.8	15.3	0.2	0.1	0.7	0.1	1.94	0.55	1.18	0.30
B22ir	13-48	60.5	36.6	2.9	1.5	0.1	5.3	15.5	0.3	9.3	0.1	0.1	-	-	0.90	0.47	0.19	0.20
B3	48-74	66.4	31.8	1.8	0.6	-	5.3	4.9	0.3	2.0	-	0.1	-	-	0.50	0.18	0.12	0.08
C1	74-99	68.7	29.0	2.3	0.4	-	5.3	3.1	0.8	1.5	-	0.1	-	-	0.35	0.10	0.06	0.05
C2x	99-114	55.5	42.1	2.4	0.4	-	5.2	3.1	0.7	0.8	-	0.1	-	-	0.34	0.10	0.07	0.05
								Marlow Series (Sandy Subsoil Variant) (Pedon 8)										
O22	5-0				49.2	1.7	3.7	123.9	10.1	88.2	1.4	0.4	3.1	1.3	0.18	0.07	0.07	0.03
A2	0-13	63.5	34.6	1.9	1.1	0.1	3.7	4.7	0.3	4.1	0.1	0.1	0.1	-	0.15	0.02	0.01	0.02
B21ir	13-20	74.9	20.4	4.7	4.2	0.2		47.3	1.3	23.5	0.1	0.1	-	-	2.05	0.82	0.98	0.50
B22ir	20-36	82.5	12.7	4.8	1.3	0.1	5.1	18.0	0.7	9.2	0.1	0.1	-	-	1.09	0.57	0.10	0.20
B23	36-64	70.0	27.2	2.8	0.8	0.1	5.2	7.5	0.4	3.2	0.1	-	-	-	0.37	0.22	0.05	0.11
C1x	64-81	67.5	30.7	1.8	0.3	-	5.4	2.4	0.6	1.1	0.1	-	-	-	0.27	0.10	0.03	0.06
C2x	81-102	61.5	36.8	1.7	0.4	-	5.2	2.9	0.5	1.7	0.1	0.1	-	-	0.30	0.10	0.07	0.05

SPODIC HORIZON CHARACTERISTICS

Table 1: (cont.)

Horizon	Depth	Sand	Silt	Clay	Organic C	Total N	pH (H2O)	Titratable Acidity (pH 8.2)	Exchange Bases	CEC (pH 7.0)	Exchange Cations K	Na	Ca	Mg	Citrate-Dithionite Fe	Al	Pyrophosphate Fe	Al
	cm				%					me/100g							%	
Unnamed Series (Pedon 9)																		
O22	3-0				32.5	1.5	4.3	57.1	12.2	57.3	1.0	0.3	9.9	1.6	0.30	0.07	0.11	0.01
A2	0-5	74.1	23.2	2.7	2.0	0.1	4.0	5.9	0.8	6.0	0.1	0.1	0.4	0.1	0.26	0.04	0.04	0.01
B21h	5-10	73.3	24.1	2.6	7.4	0.4	4.1	44.4	1.1	26.4	0.2	0.4	0.3	0.1	2.29	0.36	1.65	0.23
B22ir	10-20	67.6	29.4	2.9	3.4	0.2	4.9	37.0	1.5	21.2	-	0.1	-	-	0.96	0.90	0.20	0.34
B23ir	20-38	65.8	31.3	2.9	1.6	0.1	5.2	16.7	0.7	9.5	0.1	0.1	-	-	0.80	0.50	0.10	0.15
B24ir	38-61	67.9	29.1	3.0	1.0	0.1	5.3	10.9	0.8	6.2	-	0.1	0.1	-	0.58	0.33	0.08	0.10
B3	61-99	70.7	26.0	3.3	0.5	0.1	5.2	5.8	0.2	3.2	-	0.1	0.1	-	0.44	0.18	0.08	0.06
Cx	99-114	75.2	24.8	2.4	0.3	-	5.2	2.8	0.4	2.6	-	0.1	0.1	-	0.38	0.11	0.08	0.03

Table 2: Properties of Sampled Soils in Relation to Chemical Criteria of Spodic Horizons

Horizon	Thickness	if Fe >0.1, % pyrophosphate Fe+Al / % Clay	if Fe <0.1, % pyrophosphate Al + % Carbon / % clay	% pyrophosphate Fe+Al / % citrate-dithionite Fe+Al	Index of Accumulation	horizons qualifying for spodic by chemical criteria only?	depth of Lower Boundary
	cm						cm
			HAPLORTHODS				
			Unnamed Series (Pedon 1)				
A2	5		0.63	0.24	44	no	
B21h	8	0.31		0.53	448	yes	13
B22ir	20	0.10		0.22	361	no	
B23	25		0.48	0.26	228	no	
IIC	44		0.62	0.31	398	no	
			Unnamed Series (Pedon 2)				
A2	8		0.15	0.33	26	no	
B21h	10	0.38		0.58	233	yes	18
B22ir	15	0.11		0.41	195	no	
B23	10	0.13		0.59	81	no	
B24	21	0.14		0.30	92	no	
C1	30		0.15	0.17	63	no	
C2	15		0.01	0.10	14	no	
			Waumbek Series, Taxadjunct (Pedon 3)				
A2	3	0.03		0.23	27	no	
B21h	5	0.22		0.68	187	yes	8
B22ir	15	0.24		0.50	296	yes	23
B23ir	28	0.14		0.45	304	no	
B24	25	0.12		0.34	135	no	
C	33		0.16	0.14	30	no	
			Unnamed series (Pedon 4)				
A2	8		0.67	0.10	31	no	
B21h	2	0.41		0.68	75	yes	10
B22ir	10	0.42		0.64	378	yes	20
B23	18	0.14		0.32	334	no	
B24	23	0.09		0.30	221	no	
B25	28	0.08		0.36	154	no	

Table 2: (cont.)

Horizon	Thickness	if Fe >0.1, % pyrophosphate Fe+Al / % Clay	if Fe <0.1, % pyrophosphate Al + % Carbon / % clay	% pyrophosphate Fe+Al / % citrate-dithionite Fe+Al	Index of Accumulation	horizons qualifying for spodic by chemical criteria only?	depth of Lower Boundary
	cm						cm
PRAGIORTHODS							
Marlow Series (Pedon 5)							
A2	5		0.62	0.37	22	no	
B21h	8	0.26		0.55	191	yes	13
B22ir	7	0.23		0.50	88	yes	20
B23ir	21	0.20		0.64	164	yes	41
B24	12	0.21		0.58	79	yes	53
B3	31	0.65		0.48	109	no	
Cx	30	0.15		0.31	92	no	
Unnamed Series (Pedon 6)							
A2	3	0.06		0.39	33	no	
B21h	10	0.33		0.63	240	yes	13
B22ir	30	0.13		0.45	360	no	
B3	51	0.15		0.39	217	no	
Cx	20	0.19		0.30	66	no	
Unnamed Series (Pedon 7)							
A2	5		0.53	0.38	35	no	
B21h	8	0.44		0.59	296	yes	13
B22ir	35	0.13		0.28	502	no	
B3	26	0.11		0.29	112	no	
C1	25	0.05		0.24	69	no	
C2x	15	0.05		0.27	39	no	
Marlow Series (sandy subsoil variant) (Pedon 8)							
A2	13		0.58	0.18	53	no	
B21ir	7	0.31		0.52	324	yes	20
B22ir	16	0.06		0.18	261	no	
B23	28		0.33	0.27	182	no	
C1x	17		0.20	0.24	36	no	
C2x	21		o.26	0.30	54	no	

SPODIC HORIZON CHARACTERISTICS

Table 2: (cont.)

Horizon	Thickness	if Fe >0.1, % pyrophosphate Fe+Al / % Clay	if Fe <0.1, % pyrophosphate Al + % Carbon / % clay	% pyrophosphate Fe+Al / % citrate-dith-ionite Fe+Al	Index of Accumulation	horizons qualifying for spodic by chemical criteria only?	depth of Lower Boundary
	cm						cm
			Unnamed Series (Pedon 9)				
A2	5		0.74	0.17	27	no	
B21h	5	0.72		0.71	221	yes	10
B22ir	10	0.19		0.29	371	no	
B23ir	18	0.09		0.19	287	no	
B24ir	23		0.37	0.20	235	no	
B3	38		0.17	0.23	165	no	
Cx	15		0.14	0.22	30	no	

Table 3: Placement of Studied Soils at the Subgroup Level in Soil Taxonomy

Horizon	Depth	Continuous Cemented Horizon?	Organic Carbon	Texture	Moist Color Value	Moist Color Chroma	Subgroup Placement
	cm						
			Unnamed Series (Pedon 1)				
B21h	5-13	no	6.4	fsl	3	4	Typic
B22ir	13-33	no	1.9	cosl	5	6	Dystrochrepts(1)
B23	33-58	no	1.0	lcos	5	6	
			Unnamed Series (Pedon 2)				
*B21h	8-18	no	2.7	cosl	2	2	Typic
B22ir	18-33	no	1.4	cosl	3	4	Haplorthods
B23	33-43	no	0.8	cosl	5	4	
B24	43-64	no	0.4	cosl	5	6	
			Waumbek Series, taxadjunct (Pedon 3)				
*B21h	3-8	no	4.9	cosl	2	2	Typic
*B22ir	8-23	no	2.5	grcols	3	3	Haplorthods
B23ir	23-51	no	0.8	vgrcos	4	4	
B24	51-76	no	0.8	vgrcos	5	3	
			Unnamed Series (Pedon 4)				
*B21h	8-10	no	4.0	cosl	3	2	Typic
*B22ir	10-20	no	4.2	grcosl	3	4	Haplorthods
B23	20-38	no	1.8	grcosl	4	4	
B24	38-61	no	1.0	grcosl	5	8	
B25	61-89	no	0.5	grcos	4	4	
			Marlow Series (Pedon 5)				
*B21h	5-13	no	3.0	cosl	3	2	Typic
*B22ir	13-20	no	1.6	sl	3	4	Fragiorthods
*B23ir	20-41	no	0.9	sl	5	6	
*B24	41-53	no	0.6	cosl	5	6	
			Unnamed Series (Pedon 6)				
B21h	5-13	no	2.6	cosl	3	4	Typic
B22ir	13-43	no	0.8	cosl	4	4	Fragiochrepts(1)
			Unnamed Series (Pedon 7)				
B21h	3-13	no	3.3	fsl	3	2	Typic
B22ir	13-48	no	1.5	cosl	5	6	Fragiochrepts(1)
			Marlow Series (sandy subsoil variant) (Pedon 8)				
*B21ir	13-20	no	4.2	lcos	3	2	Typic
B22ir	20-36	no	1.3	lcos	5	8	Fragiorthods
B23	36-64	no	0.8	cosl	5	6	
			Unnamed Series (Pedon 9)				
B21h	5-10	no	7.4	lcos	2	2	Typic
B22ir	10-20	no	3.4	cosl	3	4	Fragiochrepts(1)
B23ir	20-38	no	1.6	cosl	5	6	
B24ir	38-61	no	1.0	cosl	5	4	

* Meets spodic horizon requirements
(1) Pedon does not meet spodic horizon depth requirements

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APPENDIX

Pedon 1

Unnamed series. The site location is 515m above sea level on an upper slope position of the glaciated uplands. The pedon site is located in the southeast corner of compartment 35, about 17 meters north of Bear Notch Road. This well drained soil developed in glacial till underlain by sand and gravel at 58 cm. Dominant vegetation is beech *(Fagus grandifolia),* sugar maple *(Acer saccharum),* and yellow birch *(Betula lutea).*

Horizon	*Depth cm*	*Description*
021	5-4	Loose leaf litter.
022	4-0	Well decomposed forest floor litter; black (10YR 2/1); extremely acid; many roots.
A2	0-5	Brown (7.5YR 5/2) fine sandy loam; weak medium granular structure; friable; extremely acid; roots are common; abrupt broken boundary.
B21h	5-13	Dark reddish brown (5YR 3/4) fine sandy loam; moderate medium granular structure; friable; very strongly acid; many roots; 5 percent coarse fragments; abrupt broken boundary.
B22ir	13-33	Strong brown (7.5YR 5/6) fine sandy loam; moderate medium granular structure; friable; very strongly acid; many roots; 15 percent coarse fragments; clear wavy boundary.
B23	33-58	Yellowish brown (10YR 5/6) very gravelly fine sandy loam; weak medium granular structure; friable; strongly acid; roots are common; 60 percent coarse fragments; abrupt smooth boundary.
IIC	58-102	Dark yellowish brown (10YR 4/4) sand and gravel; single grain structure; loose; very strongly acid; roots are common.

Pedon 2

Unnamed series. The site location is 300m above sea level on a toe slope position of the glaciated uplands. The pedon site is located in the southern part of compartment 2, about 30 meters east of Bear Notch Road. This moderately well drained soil developed in fine sandy loam glacial till. Dominant vegetation includes sugar maple *(Acer saccharum),* white birch *(Betula papyrifera),* yellow birch *(Betula lutea),* and hemlock *(Tsuga canadensis).*

Horizon	*Depth cm*	*Description*
021	6-5	Loose leaf litter.
022	5-0	Well decomposed forest floor litter; black (5YR 2/1); extremely acid; many roots.
A2	0-8	Light brownish gray (2.5Y 6/2) loamy fine sand; weak medium granular structure; friable; extremely acid; few roots; 10 percent coarse fragments; abrupt broken boundary.
B21h	8-18	Very dusky red (2.5YR 2/2) fine sandy loam; weak medium

		granular structure; friable; extremely acid; roots are common; 5 percent coarse fragments; abrupt broken boundary.
B22ir	18-33	Dark yellowish brown (10YR 3/4) fine sandy loam; weak medium granular structure; friable; very strongly acid; roots are common; 10 percent coarse fragments; clear wavy boundary.
B23	33-43	Yellowish brown (10YR 5/4) fine sandy loam; weak medium granular structure; friable; strongly acid; 15 percent coarse fragments; abrupt wavy boundary.
B24	43-64	Yellowish brown (10YR 5/6) fine sandy loam with many medium distinct light yellowish brown (2.5Y 6/4) and yellowish red (5YR 4/8) mottles; massive; weakly cemented; strongly acid; few roots; 15 percent coarse fragments; abrupt smooth boundary.
C1	64-94	Light yellowish brown (2.5Y 6/4) fine sandy loam; massive; firm; strongly acid; few roots; 15 percent coarse fragments; clear wavy boundary.
C2	94-109	Light yellowish brown (2.5Y 6/4) fine sandy loam; massive; friable; strongly acid; few roots; 5 percent coarse fragments.

Pedon 4

Unnamed series. The site location is 420m above sea level on a mid-slope position of the glaciated uplands. The pedon site is located in compartment 28 near the border to compartment 27, and about 125 meters north of Bear Notch Road. This moderately deep, well drained soil developed in glacial till.

Horizon	*Depthcm*	*Description*
021	4-3	Loose leaf litter.
022	3-0	Well decomposed forest floor litter; black (5YR 2/1) very strongly acid; many roots.
A2	0-8	Dark gray (10YR 4/1) fine sandy loam; weak medium granular structure; friable; very strongly acid; few roots; abrupt broken boundary.
B21h	8-10	Dark brown (7.5YR 3/2) fine sandy loam; moderate medium granular structure; friable; very strongly acid; many roots; 5 percent coarse fragments; abrupt broken boundary.
B22ir	10-20	Dark reddish brown (5YR 3/4) fine sandy loam; moderate medium granular structure; friable; very strongly acid; many roots; 15 percent coarse fragments; clear wavy boundary.
B23	20-38	Dark brown (7.5YR 4/4) fine sandy loam; moderate medium granular structure; friable; very strongly acid; roots are common; 15 percent coarse fragments; clear wavy boundary.
B24	38-61	Yellowish brown (10YR 5/8) fine sandy loam; moderate medium granular structure; friable; very strongly acid; roots are common; 15 percent coarse fragments; clear wavy boundary.
B25	61-89	Dark yellowish brown (10YR 4/4) gravelly loamy sand;

		massive; friable; very strongly acid; few roots; 30 percent coarse fragments; clear wavy boundary.
C	89-96	Dark yellowish brown (10YR 4/4) very gravelly loamy sand; massive; friable; strongly acid; few roots; 60 percent coarse fragments; abrupt wavy boundary.
R	96	Bedrock.

Pedon 6

Unnamed series. The site location is 420m above sea level on a mid-slope position of the glaciated uplands. The pedon site is located in the southeast corner of compartment 22, about 125 meters north of Bear Notch Road. This well drained soil developed in glacial till and has a compact pan at 94 cm. Dominant vegetation is sugar maple *(Acer saccharum)* with white birch *(Betula papyrifera),* yellow birch *(Betula lutea),* and beech *(Fagus grandifolia).*

Horizon	*Depth cm*	*Description*
021	10-8	Loose leaf litter.
022	8-0	Well decomposed forest floor litter; black (5YR 2/1); very strongly acid; many roots.
A2	0-3	Light brownish gray (10YR 6/2) fine sandy loam; weak fine granular structure; friable; very strongly acid; roots are common; abrupt broken boundary.
B21h	3-13	Dark reddish brown (5YR 3/4) fine sandy loam; weak fine and medium granular structure; friable; very strongly acid; many roots; 5 percent coarse fragments; abrupt broken boundary.
B22ir	13-43	Dark brown (7.5YR 4/4) gravelly fine sandy loam; weak fine and medium granular structure; friable; strongly acid; many roots; 20 percent coarse fragments; clear wavy boundary.
B3	43-94	Yellowish red (5YR 4/6) gravelly loamy sand with few distinct grayish brown (2.5Y 5/2) mottles at 55 cm; strongly acid; roots are common; 45 percent coarse fragments; alternating lenses of segregated clean sand and gravel with fine sandy loam textures comprise the textural fabric; abrupt wavy boundary.
CX	94-114	Mottles yellowish red (2.5Y 6/2) fine sandy loam; massive; firm in place, friable removed; strongly acid; few roots in the very fine sandy loam gray (5Y 6/1) vertical faces of polygons; 10 percent coarse fragments.

Pedon 7

Unnamed series. The site location is 420m above sea level on a mid-slope position of the glaciated uplands. The pedon site is located south of Bear Notch Road and opposite the boundary separating compartments 22 and 23. This well drained soil developed in stony compact glacial till derived mostly from granitic

and schistose rocks. Dominant vegetation is beech *(Fagus grandifolia)* and striped maple *(Acer pensylvanicum)* with scattered hemlock *(Tsuga canadensis).*

Horizon	*Depth cm*	*Description*
021	10-8	Loose leaf litter.
022	8-0	Black (5YR 2/1) well decomposed forest floor litter; very strongly acid; many roots.
A2	0-5	Gray (10YR 5/1) sandy loam; weak fine granular structure; friable; very strongly acid; roots are common; 5 percent coarse fragments; abrupt broken boundary.
B21h	5-13	Dark brown (7.5YR 3/2) fine sandy loam; moderate medium granular structure; friable; very strongly acid; many roots; 5 percent coarse fragments; abrupt broken boundary.
B22ir	13-48	Yellowish brown (10YR 5/6) coarse sandy loam; moderate medium granular structure; friable; strongly acid; many roots; 15 percent coarse fragments; clear wavy boundary.
B3	48-74	Yellowish brown (10YR 5/4) sandy loam with few medium faint yellowish brown (10YR 5/8) mottles; weak coarse platy structure; friable; strongly acid; few roots; 15 percent fragments; abrupt wavy boundary.
C1	74-99	Light olive brown (2.5Y 5/4) fine sandy loam with few medium distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/8) mottles; weak coarse platy structure; friable; strongly acid; few roots; 15 percent coarse fragments; abrupt wavy boundary.
C2x	99-114	Light olive gray (5Y 6/2) fine sandy loam with many coarse distinct dark brown (7.5YR 4/4) mottles; massive; firm; strongly acid; few roots; 12 percent coarse fragments.

Pedon 8

Marlow series, sandy subsoil variant. The site location is 305m above sea level on a low slope position of the glaciated uplands. The pedon site is located in the southeast corner of compartment 14, about 50 meters west of Bear Notch Road. This well drained soil developed in glacial till and has a compact pan at 64 cm. Dominant vegetation is sugar maple *(Acer saccharum),* beech *(Fagus grandifolia),* yellow birch *(Betula lutea),* and hemlock *(Tsuga canadensis).*

Horizon	*Depth cm*	*Description*
021	6-5	Loose leaf litter.
022	5-0	Well decomposed forest floor litter; black; (5YR 2/1); extremely acid; many roots;
A2	0-13	Light brownish gray (10YR 6/2) loamy fine sand; moderate medium granular structure; friable; extremely acid; roots common; 10 percent coarse fragments; abrupt broken boundary.

B21ir	13-20	Dusky red (2.5YR 3/2) fine sandy loam; moderate medium granular structure; friable; very strongly acid; many roots; 15 percent coarse fragments; abrupt broken boundary.
B22ir	20-36	Strong brown (7.5YR 5/8) loamy fine sand; moderate medium granular structure; friable; very strongly acid; many roots; 15 percent coarse fragments; clear wavy boundary.
B23	36-64	Yellowish brown (10YR 5/6) fine sandy loam; moderate medium granular structure; friable; very strongly acid; roots are common; 15 percent coarse fragments; abrupt wavy boundary.
CIX	64-81	Light yellowish brown (2.5Y 6/4) fine sandy loam; weak coarse platy structure; firm; strongly acid; fabric of fragipan includes both segregated fine and medium sand lenses in horizontal orientation and fine sandy loam; silt coatings on coarse fragments; clear wavy boundary.
C2X	81-102	Light yellowish brown; fine sandy loam with common medium distinct yellowish red (5YR 5/8) mottles; weak coarse platy structure; firm; strongly acid; fabric of fragipan includes both segregated fine and medium sand lenses in horizontal orientation and fine sandy loam; silt coatings on coarse fragments.

Pedon 9

Unnamed series. The site location is 465m above sea level on an upper slope position of the glaciated uplands. The pedon site is located south of Bear Notch Road, opposite from the boundary separating compartments 27 and 28. This well drained soil developed in glacial till and has a compact pan at 99 cm. Dominant vegetation is beech *(Fagus grandifolia)* with hemlock *(Tsuga canadensis)*, yellow birch *(Betula lutea)* and striped maple *(Acer pensylvanicum)*.

Horizon	*Depth cm*	*Description*
021	6-3	Loose leaf litter.
022	3-0	Well decomposed forest floor litter; black (5YR 2/1) extremely acid; many roots; abrupt smooth boundary.
A2	0-5	Dark brown (7.5YR 4/4) and (7.5YR 4/2) fine sandy loam; weak fine granular structure; friable; strongly acid; roots are common; 5 percent coarse fragments; abrupt broken boundary.
B21h	5-10	Very dusky red (2.5YR 2/2) fine sandy loam; moderate medium granular structure; friable; extremely acid; many roots; 3 percent coarse fragments; abrupt broken boundary.
B22ir	10-20	Dark reddish brown (5YR 3/4) fine sandy loam; moderately medium granular structure; friable; strongly acid; many roots; 5 percent coarse fragments; abrupt wavy boundary.
B23ir	20-38	Yellowish brown (10YR 5/6) fine sandy loam; moderate medium granular structure; friable; strongly acid; roots are common; 10 percent coarse fragments; clear wavy boundary.
B24ir	38-61	Yellowish brown (10YR 5/4) fine sandy loam; moderate

		medium granular structure; friable; very strongly acid; roots are common; 15 percent coarse fragments; clear wavy boundary.
B3	61-99	Yellowish brown (10YR 5/4) fine sandy loam with few distinct medium yellowish brown (10YR 5/8) mottles; weak coarse platy structure; friable; strongly acid; few roots; 15 percent coarse fragments; abrupt wavy boundary.
CX	99-114	Light olive brown (2.5Y 5/4) gravelly loamy sand; massive, firm; strongly acid; few roots; 25 percent coarse fragments; fabric of fragipan includes both segregated fine and medium sand lenses in horizontal orientation and fine sandy loam; silt coatings on coarse fragments.

Pedon 10 — Tree Throw Mound

Berkshire series, sandy subsoil variant. The site is located on a low slope position of the glaciated uplands. The pedon location is in the northern part of compartment 14, about 70 meters west of Bear Notch Road. This well drained soil has developed in glacial till with an overburden of about 41 cm of mounded material as a result of tree throw activity. Dominant vegetation includes beech *(Fagus grandifolia),* yellow birch *(Betula lutea),* and white birch *(Betula papyrifera).*

Horizon	*Depth cm*	*Description*
021	5-3	Loose leaf litter, mostly yellow and white birch and beech leaves.
022	3-0	Black (N 2/) humus; many roots; abrupt wavy boundary.
A2	0-3	Gray (10YR 6/1) fine sandy loam; weak fine granular structure; very friable; many roots; very strongly acid; abrupt irregular boundary.
B21h	3-5	Dark reddish brown (5YR 2/2) loamy fine sand; weak fine granular structure; very friable; many roots; very strongly acid; abrupt irregular boundary.
B21ir	5-10	Yellowish red (5YR 4/6) fine sandy loam; weak fine granular structure; very friable; many roots; very strongly acid; abrupt wavy boundary.
B22	10-41	Yellowish brown (10YR 5/6) loamy fine sand, weak fine granular structure; friable; 5 percent coarse fragments; dark yellowish brown (10YR 3/4) material in old root channels; roots common; very strongly acid; clear wavy boundary.
A2b	41-46	Gray (10YR 6/1) fine sandy loam; weak fine granular structure; friable; occasional pocket of dark gray (5Y 4/1) material; 5 percent coarse fragments; few roots; very strongly acid; abrupt irregular boundary.
B21b	46-56	Strong brown (7.5YR 5/6) fine sandy loam; weak fine granular structure; friable; 5 percent coarse fragments; dark brown (7.5YR 4/4) material in old root channels; roots common; very strongly acid; clear wavy boundary.
B22b	56-69	Dark yellowish brown (10YR 4/4) fine sandy loam; weak fine

		granular structure; friable; 5 percent coarse fragments; few weathered Conway granite fragments over 3 inches diameter; dark brown (7.5YR 2/2) material in old root channels; roots common; very strongly acid; clear wavy boundary.
B3b	69-86	Matrix light olive brown (2.5Y 5/4) loamy fine sand, with few fine distinct strong brown (7.5YR 5/8) mottles; massive in place breaking to weak fine granular; friable; 8 percent coarse fragments; few weathered Conway granite fragments over 3 inches diameter; very fine sand and silt caps on many coarse fragments; light gray (10YR 7/1) areas of uncoated sand grains up to ¼'' diameter; few roots; very strongly acid; clear wavy boundary.
C1	86-104	Matrix light brownish gray (2.5Y 6/2) fine sandy loam; massive; friable; 8 percent coarse fragments; few weathered Conway granite fragments over 3 inches diameter; very fine sand and silt caps on many coarse fragments; no roots; very strongly acid; clear wavy boundary.
C2	104-117	Matrix light brownish gray (2.5Y 6/2) fine sandy loam, with many medium distinct yellowish red (5YR 5/8) mottles; massive; friable; 5 percent coarse fragments; few weathered Conway granite fragments over 3 inches diameter; very fine sand and silt caps on many coarse fragments; very strongly acid.

[1]Messrs. F. Vieira and R. Reiske assisted in this description.

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